

## QUAD CHAIR WITH SAFETY SPACER

### Field of The Invention

Collapsible Furniture, and particularly collapsible chairs having a quad structure.

### 5 Background of The Invention

Folding chairs are relatively popular, in part because they can be stored at considerably reduced space requirements when compared to non-folding chairs. Exemplary folding chairs with solid arm rests and seat support rods are described in U.S. Pat. No. 4,613,185 to *Marchesini et al.* (September 23, 1986), U.S. Pat. No. 5,899,525 to *Tseng* (May 10, 1999), U.S. Pat. No. 5,947,553 to *Tseng* (September 7, 1999), and U.S. Pat. No. 6,062,639 to *Hill* (May 16, 2000), all of which are incorporated by reference herein.

Nevertheless, previously known folding chairs still take up a relatively large space when folded, since the dimension of the folding chair is generally reduced only along one space coordinate (*e.g.*, reduced length). To further reduce the space requirement, collapsible chairs have been developed in which further size reduction is achieved by folding the chair along at least two space coordinates (*e.g.*, length and width). Various collapsing chairs are known in the art.

In most of the known collapsible chairs, the collapsing action is achieved by using a quad configuration and exemplary collapsible chairs with such quad configuration are described in U.S. Pat. No. 6,322,138 to Tang, U.S. Pat. Nos. 6,237,993 and 6,231,119 to Zheng, and U.S. Pat. No. 5,984,406 to Lee, all of which are incorporated by reference herein. While such chairs provide substantial increase in collapsibility by virtue of their quad configuration, new problems arise. Most significantly, where an operator folds the chair from the open to the collapsed configuration, the chair needs careful manipulation to prevent injury to the operators hand as almost all of the parts are moving parts that approximate each other in a scissor-like movement as the chair is collapsed.

Therefore, while there are numerous configurations for collapsible chairs are known in the art, all or almost all of them suffer from one or more disadvantages. Consequently, there is still a need to provide improved collapsible chairs with quad configuration that significantly reduce the chance of injury as the chair is being collapsed.

### Summary of the Invention

The present invention is directed to configurations and methods for a collapsible chair having a quad configuration in which a spacer increases the distance between the cross bars of a cross brace to thereby reduce or prevent injury to a user's hand or fingers as the used 5 collapses the chair.

In one aspect of the inventive subject matter, a collapsible chair has a first cross brace with a first cross bar and a second cross bar, and a second cross brace with a third cross bar and a fourth cross bar. In such chairs, the first and second cross braces are coupled to each other via a third cross brace with a fifth cross bar and a sixth cross bar and a fourth cross 10 brace with a seventh cross bar and an eighth cross bar, such that one end of the first cross bar is pivotably coupled to one end of the eighth cross bar and one end of the second cross bar is pivotably coupled to one end of the third cross bar to thereby form a quad structure. Each of the first cross bar and the second cross bar, the third cross bar and the fourth cross bar, the fifth cross bar and the sixth cross bar, and the seventh cross bar and the eighth cross bar are 15 rotatably coupled to each other via a first, second, third, and fourth axis, respectively, and at least one of the first, second, third, and fourth axes is coupled to a spacer element that maintains a minimum distance of at least 1 cm between the cross bars that are rotatably coupled to each other, wherein the spacer element reduces collapsibility of the collapsible chair as compared to the chair without the spacer element.

Therefore, in another aspect of the inventive subject matter, a spacer having a first and a second end may include a continuous channel formed therein, wherein the continuous channel is configured to receive an axis that rotatably connects a first cross bar with a second cross bar in a collapsible chair that has a quad configuration, and wherein the first and second ends engage with the first and second cross bars such that the first and second cross bars 20 remain at a distance of at least 1 cm from each other as the collapsible chair collapses.

Various objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of preferred embodiments of the invention.

### Brief Description of The Drawing

Figure 1 is a perspective view of an exemplary collapsible chair having a spacer element according to the inventive subject matter.

Figure 2 is a detail view of the collapsible chair of Figure 1.

### Detailed Description

The inventor has discovered that safety for collapsible quad chairs can be significantly improved by providing a spacer element that is configured to maintain the distance between moving cross bars of a cross brace. Such spacers are particularly useful in helping to prevent 5 injuries to the user's hand and/or fingers as the chair is collapsed from an open to a closed configuration.

The term "quad" or "quad structure" are used interchangeably herein and refer to a configuration that comprises a plurality of elements in which four pairs of two elements are coupled to each other form a polygon of four sides, wherein the two elements of each pair are 10 rotatably coupled to each other, and at least one element of one side is rotatably or slidably coupled to one element of another side. In especially preferred quad structures, four pairs of cross braces (with each cross brace comprising two cross bars rotatably coupled to each other and forming an X) are movably coupled to each other such that when the cross bars of one cross brace rotate relative to each other, the quad structure collapses in a single motion.

As also used herein, the term "collapses in a single movement" or "collapses in a single motion" are used interchangeably and refer to a movement in which a user need not interrupt the collapsing motion to fasten or unfasten a connector. Thus, the term "collapses in a single movement" may also include multiple sub-movements, which may or may not be separated by a pause. As still further used herein, the term "open configuration" refers to the 20 configuration of the collapsible chair in which the front legs have a maximum distance from each other when the chair is opened using reasonable force (*i.e.* without damaging the mechanical structure). Similarly, the term "closed configuration" refers to the configuration of the collapsible chair in which the front legs have a minimum distance from each other when the chair is closed using reasonable force (*i.e.* without damaging the mechanical structure).

In a especially preferred aspect of the inventive subject matter as depicted in **Figure 1**, a collapsible children's chair 100 (*i.e.*, a chair proportioned for use by a child, preferably less than 10 years of age) has a seat 110 continuous with a back 120, and a pair of armrests 130. The chair is configured as a quad chair that collapses in a single motion, and quad structure 140 is partially shown, having a cross brace 150 with first and second cross bars 152 and 154, 30 respectively. The cross bars 152 and 154 are rotatably coupled to each other via axis 156 that is partially disposed in cylindrical spacer element 160.

A more detailed view of chair 100 is provided in **Figure 2** in which the quad structure is formed by first, second, third, and fourth cross braces 210, 220, 230, and 240, respectively. First cross brace 210 has first and second cross bars 212 and 214, second cross brace 220 has third and fourth cross bars 222 and 224, third cross brace 230 has fifth and sixth cross bars 232 and 234, and fourth cross brace 240 has seventh and eighth cross bars 242 and 244, wherein the cross bars in each cross brace are rotatably coupled to each other via axis, 216, 226, 236, and 246. Coupled to each axis is a cylindrical spacer element 218, 228, 238, and 248 (not shown), respectively, that at least partially encloses the axis and further maintains the cross bars at a predetermined distance. One cross brace is movably coupled to two adjacent cross braces by foot elements via pivotable couplings, and by top elements via pivotable and/or slid able couplings. It is further particularly preferred that the arm rests are coupled to the chair via back rods 250 and the extended ends of the cross bars of the third cross brace 230. The cross braces are further pivotably coupled to each other via pedestal connectors 260, wherein the distance between the cross bars generated by the spacer element is maintained by a supplemental spacer 262 that is coupled to or otherwise part (e.g., integral part) of the pedestal connector 260 (shown only for two of the pedestal connectors). Thus, the supplemental spacer 262 is configured to cooperate with at least one of the spacers to maintain the distance between the cross braces along the entire length of the cross braces as the chair is collapsed.

In operation, the quad chair collapses in a single motion via coordinated scissor-like pivoting movement of the cross bars relative to each other. Consequently, in heretofore known collapsible chairs with quad structure, the chair is most easily collapsed by holding on at least one of the cross bars while exerting force to the at least one cross bar. Unfortunately, where the user fails to remove his or her fingers from the cross bar while collapsing the chair, pinching injuries are likely to occur. Thus, it should be particularly appreciated that the spacers will minimize the likelihood of such injuries, while maintaining the ease of operation of contemplated chairs. However, it should be appreciated that the spacer element will reduce the collapsibility, typically by the sum of the length of two spacer elements opposite to each other. The term "reduce collapsibility" as used herein means that the collapsed chair will have an increased width and/or length as compared to the same collapsed chair without the spacer element.

Consequently, and depending on the particular user requirements, it should be recognized that configuration and dimensions of contemplated spacers may vary substantially.

For example, suitable spacers will typically have cylindrical shape with a length between 0.25 cm and 4 cm, and a diameter of between about 0.5 cm and 3 cm. Consequently, preferred spacers will maintain a minimum distance of at least 1 cm, and more typically at least 1.5 cm between the cross bars. However, alternative configurations are also contemplated, including  
5 spacers with spherical shape, cube or rectangular shape, or irregular shape. Furthermore, the length (*i.e.*, the dimension that determines the distance between the cross bars) of the spacer may vary considerably and in relatively few cases may be less than 0.25 cm. Similarly, and especially where the length is relatively large, the length may be between 4 and 6 cm, and even more. Moreover, preferred spacers will include a channel that at least partially encloses  
10 the axis that rotatably couples the cross bars.

Alternatively, and especially where it is desired that the spacer is permanently mounted to the axis, the spacer may be integral with the axis. In such embodiments, the axis may include a first portion (located between the cross bars) with a first diameter, while a second portion (rotatably coupled to the cross bars) has a second diameter, wherein the first diameter is larger than the second diameter. Similarly, the axis may also include two beads or otherwise enlarged elements in fixed relationship to the remaining portion of the axis,  
15 wherein the beads maintain the distance between the first and second cross bars. It should still further be appreciated that the spacer can be manufactured from numerous materials and combinations thereof, including natural and synthetic polymers, metals, and metal alloys.

Consequently, the inventors contemplate a collapsible chair having a first cross brace with a first cross bar and a second cross bar, and a second cross brace with a third cross bar and a fourth cross bar, wherein the first and second cross braces are coupled to each other via a third cross brace with a fifth cross bar and a sixth cross bar and a fourth cross brace with a seventh cross bar and an eighth cross bar, such that one end of the first cross bar is pivotably  
20 coupled to one end of the eighth cross bar and one end of the second cross bar is pivotably coupled to one end of the sixth cross bar to thereby form a quad structure. In such chairs, each of the first cross bar and the second cross bar, the third cross bar and the fourth cross bar, the fifth cross bar and the sixth cross bar, and the seventh cross bar and the eighth cross bar are rotatably coupled to each other via a first, second, third, and fourth axis, respectively, wherein  
25 at least one of the first, second, third, and fourth axes is coupled to a spacer element that maintains a minimum distance of at least 1 cm between the cross bars that are rotatably coupled to each other, and wherein the spacer element reduces collapsibility of the collapsible chair as compared to the chair without the spacer element.  
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Viewed from another perspective, the inventors particularly contemplate a spacer with a continuous channel formed therein, wherein the spacer has a first end and a second end, and wherein the continuous channel is configured to receive an axis that rotatably connects a first cross bar with a second cross bar in a collapsible chair that has a quad configuration. In 5 contemplated spacers, the first and second ends engage with the first and second cross bars such that the first and second cross bars remain at a distance of at least 1 cm from each other as the collapsible chair collapses.

Thus, specific embodiments and applications of quad chairs with safety spacer have been disclosed. It should be apparent, however, to those skilled in the art that many more 10 modifications besides those already described are possible without departing from the inventive concepts herein. The inventive subject matter, therefore, is not to be restricted except in the spirit of the appended claims. Moreover, in interpreting both the specification and the claims, all terms should be interpreted in the broadest possible manner consistent with the context. In particular, the terms "comprises" and "comprising" should be interpreted as 15 referring to elements, components, or steps in a non-exclusive manner, indicating that the referenced elements, components, or steps may be present, or utilized, or combined with other elements, components, or steps that are not expressly referenced.